LEZIONE 10

Problemi sul piano inclinato

1)

$a_s = -g\sin\theta$ $\quad v_0 = 15.9\ \frac{m}{s}$

$\sin\theta = \frac{h}{L} = \frac{3}{5}$ $\quad s_0 = 0m$ $\quad H = ?$

a) $t_1 = ?$ $\quad t_1 : v = 0$

$s = s_0 + v_0 t + \frac{1}{2} a_s t^2$

$s = s_0 + v_0 t - \frac{1}{2}(g\sin\theta)t^2$

$s = v_0 t - \frac{1}{2}(g\sin\theta)t^2$

$v = v_0 + a_s t = v_0 - (g\sin\theta)t$

$v = v_0 - (g\sin\theta)t \Rightarrow 0 = v_0 - (g\sin\theta)t$

$v_0 = (g\sin\theta)\cdot t \Rightarrow t = \frac{v_0}{g\sin\theta}$

$s = v_0 \cdot \frac{v_0}{g\sin\theta} - \frac{1}{2} g \sin\theta \frac{v_0^2}{g^2\sin^2\theta}$

$s = \frac{v_0^2}{g\sin\theta} - \frac{v_0^2}{2g\sin\theta} = \frac{v_0^2}{2g\sin\theta} =$

$s = \frac{v_0^2}{2g\sin\theta} = \frac{(15,9\ m/s)^2}{2(9.8\ m/s^2)(\frac{3}{5})} = \frac{252,81\ m^2/s^2}{11,772\ m/s^2} \simeq 21,479 m$

$H = s\sin\theta = \frac{v_0^2}{2g\sin\theta}\cdot\sin\theta = \frac{v_0^2}{2g} = \frac{252,81\ m^2/s^2}{2\cdot 9.81\ m/s^2}$

$H = 12,88\ m \simeq 12,9\ m$

b) $t = \frac{v_0}{g\sin\theta} = \frac{15,9\ m/s}{(9.8\ m/s^2)\cdot(\frac{3}{5})} \simeq 2,7\ s$

$a_1 = a_{sen\theta_1} = + g \operatorname{sen}\theta$

$S_1 = S_{01} + v_{01}t + \frac{1}{2} a_{s_1} t^2$

$S_2 = S_{02} + v_{02}t + \frac{1}{2} a_{s_2} t^2$

$S_{01} + v_{01}t + \frac{1}{2} g \operatorname{sen}\theta\, t^2 = S_{02} + v_{02}t + \frac{1}{2} g \operatorname{sen}\theta\, t^2$

$\theta = 20°$

$v_{01} = 2 \frac{m}{s}$

$v_{02} = 0 \frac{m}{s}$

$S_{01} = 0\ m$

$S_{02} = 4{,}3\ m$

a) $t: S_1 = S_2$

b) $S_1 = ?$

$s_{01} + v_{01} t = s_{02} + v_{02} t$ — TEMPO INCONTRO 1 E 2 — $s_{02} = 0\,m$, $v_{02} = 0\,\frac{m}{s}$

$v_{01} t = s_{02}$

$v_{01} t = s_{02} \Rightarrow t = \frac{s_{02}}{v_{01}} = \frac{4{,}3\,m}{2\,\frac{m}{s}} = 2{,}15\,s$

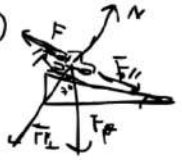
b)

$s_1 = s_{01} + v_{01} t + \frac{1}{2} g \operatorname{sen}\theta\, t^2 = v_{01} t + \frac{1}{2} g \operatorname{sen}\theta\, t^2$

$= (2\,m)(2{,}15\,s) + \frac{1}{2} \cdot \left(9{,}81\,\frac{m}{s^2}\right) \operatorname{sen} 20^\circ \cdot (2{,}15\,s)^2 =$

$= 4{,}3\,m + 7{,}75\,m = 12{,}05\,m \approx 12\,m$

③



$F_{P//} = mg\,sen\theta$

$\alpha = 7^\circ$

$m = 750\,Kg$

$F = 350\,N$

A) $a_{//} = ?$

$N = ?$

B) $F = ?$ $\quad \boxed{\sum F_{//} = 0}$

a) $\sum F_{//} = F_{P//} - F$

$ma_{//} = mg\,sen\alpha - F \Rightarrow a_{//} = \dfrac{mg\,sen\alpha - F}{m}$

$N = Kg\cdot\frac{m}{s^2}$

$a_{//} = \dfrac{mg\,sen\alpha}{m} - \dfrac{F}{m} = g\,sen\alpha - \dfrac{F}{m}$

$a_{//} = \left(9.81\,\frac{m}{s^2}\right) sen\,7^\circ - \dfrac{350\,N}{750\,Kg} = 1,195\,\frac{m}{s^2} - 0,466\,\frac{m}{s^2}$

$a_{//} = 0,729\,\frac{m}{s^2} \simeq 0,73\,\frac{m}{s^2}$

$\sum F_\perp = 0$

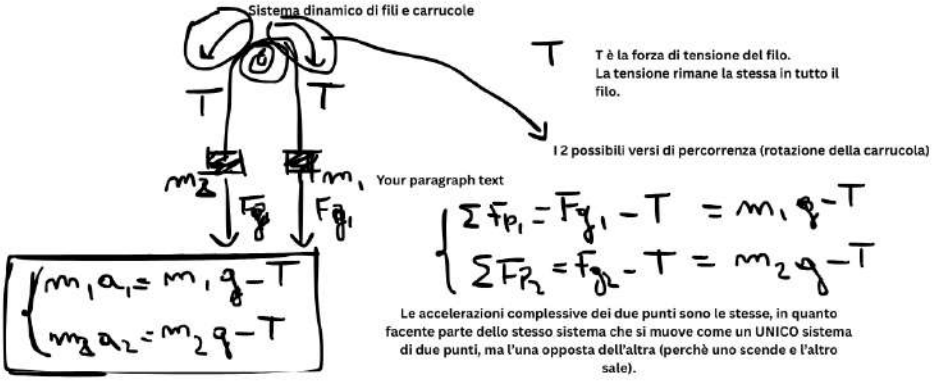
$\sum F_\perp = N - F_{P\perp} \Rightarrow N - F_{P\perp} = 0$

$N = F_{P\perp} = mg\cos\alpha = (750\,Kg)\left(9.81\,\frac{m}{s^2}\right) \cos 7^\circ = 7302,55\,N \simeq 7303\,N$

b) F: $\sum F_{//} = 0$

$F - F_{P//} = 0 \Rightarrow F = F_{P//} = mg\,sen\alpha$

$F_{P//} = (750\,Kg)\left(9.81\,\frac{m}{s^2}\right) sen\,7^\circ = 896,45\,N \simeq 897\,N$


Sistema dinamico di fili e carrucole
T
T
T
T è la forza di tensione del filo.
La tensione rimane la stessa in tutto il filo.
I 2 possibili versi di percorrenza (rotazione della carrucola)
m_2
m_1
F_{g_2}
F_{g_1}
Your paragraph text
$\begin{cases} \Sigma F_{p_1} = F_{g_1} - T = m_1 g - T \\ \Sigma F_{p_2} = F_{g_2} - T = m_2 g - T \end{cases}$
$\begin{cases} m_1 a_1 = m_1 g - T \\ m_2 a_2 = m_2 g - T \end{cases}$
Le accelerazioni complessive dei due punti sono le stesse, in quanto facente parte dello stesso sistema che si muove come un UNICO sistema di due punti, ma l'una opposta dell'altra (perchè uno scende e l'altro sale).

$-a_1 = +a_2 = a$

$$\begin{cases} m_1 a_1 = m_1 g - T \\ m_2 a_2 = m_2 g - T \end{cases}$$

$$\begin{cases} m_1(-a) = m_1 g - T \\ m_2(a) = m_2 g - T \end{cases} \Longrightarrow \begin{cases} m_1 a = T - m_1 g \\ m_2 a = m_2 g - T \end{cases}$$

$T = ?$ $a = ?$

$$\begin{cases} m_1 a = T - m_1 g \\ m_2 a = m_2 g - T \end{cases}$$

SOMO MEMBRO A MEMBRO

$$m_1 a + m_2 a = T - m_1 g + m_2 g - T$$

$$(m_1 + m_2) a = (m_2 - m_1) g$$

$$\boxed{a = \frac{m_2 - m_1}{m_1 + m_2} g}$$

$$m_1 a = T - m_1 g$$

$$m_1 \left(\frac{m_2 - m_1}{m_1 + m_2}\right) g = T - m_1 g$$

$$T = m_1 \left(\frac{m_2 - m_1}{m_1 + m_2}\right) g + m_1 g$$

$$T = \frac{m_1 m_2 g - m_1^2 g + m_1 (m_1 + m_2) g}{m_1 + m_2} =$$

$$T = \frac{m_1 m_2 g - m_1^2 g + m_1^2 g + m_1 m_2 g}{m_1 + m_2} = 2 \frac{m_1 m_2}{m_1 + m_2} g$$

$$\boxed{T = \frac{2 m_1 m_2}{m_1 + m_2} g}$$

$$\boxed{a = \frac{m_2 - m_1}{m_1 + m_2} g}$$

→ PARTITORE PI MASSE

$$\boxed{\frac{m_2 - m_1}{m_1 + m_2} < 1}$$